(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 487 836 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **91114491.3**

(51) Int. Cl.[5]: **B41F 13/34**

(22) Date of filing: **29.08.91**

(30) Priority: **28.11.90 US 619134**

(43) Date of publication of application:
03.06.92 Bulletin 92/23

(84) Designated Contracting States:
DE FR GB

(71) Applicant: **LITTLETON INDUSTRIAL CONSULTANTS, INC.**
11901 Boncliff Drive
Alden New York 14004(US)

(72) Inventor: **Littleton, Francis John**
11901 Boncliff Drive
Alden, New York 14004(US)

(74) Representative: **Haecker, Walter et al**
Patentanwaltskanzlei Hoeger, Stellrecht & Partner Uhlandstrasse 14c
W-7000 Stuttgart 1(DE)

(54) Thermal-adjustment method for controlling printing press impressions.

(57) A method for controlling the printing efficiency of a printing press by thermally maintaining the optimum orientation of the operating members. The optimum setting is maintained by thermally adjusting the length of the frame support to maintain an even pressure between printing cylinders and maintain gaps between bearers while the press is in operation.

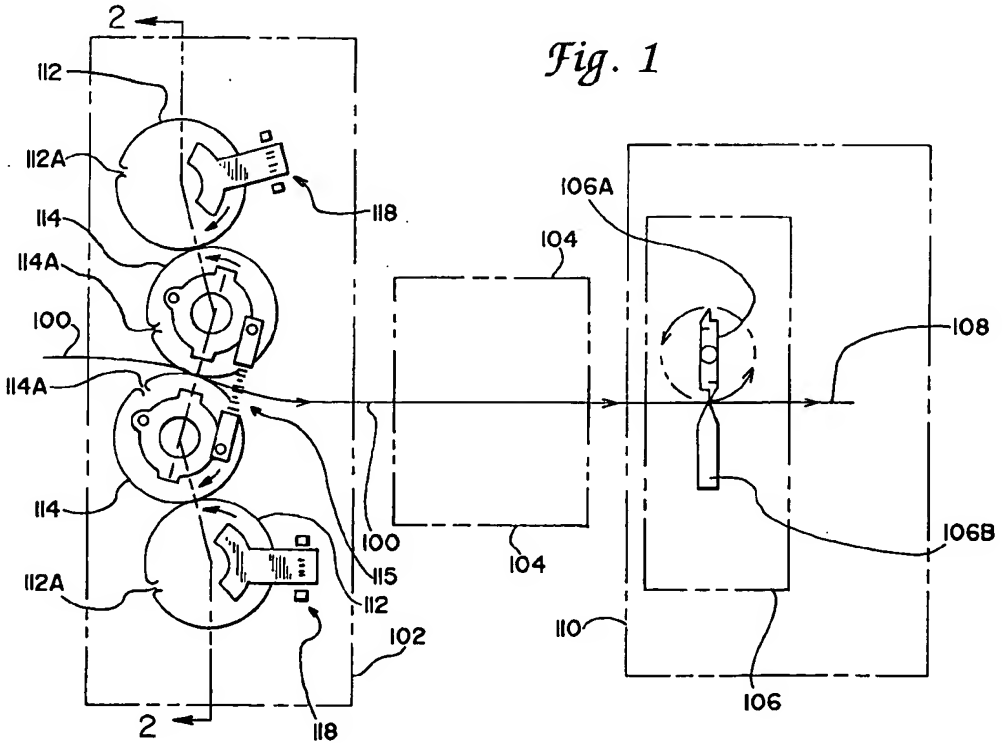

Fig. 1

EP 0 487 836 A1

Field Of The Invention

This invention relates to machines in which a first rotating member is maintained in close physical relationship to a second fixed or rotating member and more particularly to a method for thermally controlling the spacing between the bearers of the first and second members such that the machine operates "off-bearer". While the invention is thus broadly applicable, it is disclosed more fully with reference to the printing art to which it is particularly applicable.

For modern printing operations, a web of paper is fed into a printing press where it is passed between a pair of cylinders which print ink images on one or both sides of the web. In an offset press, which is selected as being representative of printing presses to which the present invention can be applied, these printing cylinders are called blanket cylinders. The blanket cylinders are precisely supported for rotation in a rigid frame which maintains a firm pressure between the cylinders. The ink images are transferred to the blanket cylinders by plate cylinders via techniques well known in the art and unimportant to the present invention.

In a conventional offset press, the blanket cylinders are connected axially to bearer elements, which in turn are connected by a journal for rotation about bearings. The bearings are fixedly attached to the frame supports, and the distance between bearings is fixed prior to operation of the press. The blanket and plate cylinders are slightly undercut from their respective bearers causing each pair of bearers to engage the other pair of bearers.

During normal operation of an offset press, the bearer elements come into contact which results in tremendous amounts of frictional force acting on the bearers. Heavy loads of up to 3 1/2 tons are added to the blanket bearers from plate cylinder bearers causing high stresses between each bearer nip (i.e. plate to blanket, blanket to blanket and blanket to plate bearers going from top to bottom in the printing unit.)

It is not uncommon in conventional offset presses for loads between blanket cylinder bearers of 5 1/2 tons at both nip points due to cylinder journal deflections inherent in the press when operating at such a load. The total load on a bearered offset press can be summed wherein there are 3 1/2 tons at each of the bearer nip points (total of 4 nip points) between blanket cylinders and plate cylinders, plus 5 1/2 tons at each nip point between blanket cylinder bearers for a total of 25 tons in each printing unit. As the press runs, this load may increase, further deflecting journals which results in curved printing cylinders resulting in diminished print quality and waste. In addition, frictional force on the bearer elements cause a heat build up at the edges of the plate and blanket cylinders causing the blanket cylinders to further bow, thereby reducing the clarity of the print.

Frictional force also causes greater wear on the bearers and bearings. The contact between bearer elements is aggravated during operation of the press by the expansion of the bearer elements due to centrifugal forces created by high speed operation. The temperature of the bearers tends to increase causing further expansion and bowing of the cylinders. This expansion by heat and erosion of the bearers by friction seriously hampers attempts to keep the press positioned to maximize print quality and efficiency.

Although it has been possible to preset the bearer elements such that they are not in contact initially, little success has been achieved in maintaining this spacing such that a good dot structure is maintained.

Even in non-bearered presses or Flexo presses journal deflection exist. Although the cylinders tend to deflect much less than bearer presses, control of the distance between cylinders is left to setting the distance between cylinders prior to operation. As the press is operated, heat generated in the frames and press speeds distort the initial setting causing print quality inefficiencies.

SUMMARY OF THE INVENTION

In accordance with the present invention, the problems involved with operating a web offset press "off-bearer" at high printing speeds are overcome by a method for thermally controlling the space between bearers. Additionally, the problem of print inefficiencies associated with non-bearered or Flexo presses is also overcome by the disclosed method.

As applied to an offset press, the pressure between a blanket cylinder and a plate cylinder can be controlled by a thermal adjusting apparatus operating on the frame which supports the cylinders as disclosed in U.S. Patent No. 4,426,897. However, the method disclosed in the '897 patent did not completely cure the problems of the plate and blanket cylinders bowing out at the edges due to the increased heat and increased load caused by friction between bearer elements, nor was it appreciated how the '897 invention could be applied to operating an offset press off-bearer. The present invention provides a method of thermally controlling the distance between the bearer elements such that a fixed space is maintained between the bearers thereby avoiding bowing of the plate and blanket cylinders. By operating off-bearer and avoiding a bowing of the blanket and plate cylinders the operational efficiency of the press is

significantly increased.

A method of operating a rotary machine in accordance with the present invention is to be applied to an apparatus comprising a frame having first and second support portions, an operating member mounted on the support portions for rotation, a cooperating member mounted on the support portions and disposed relative to the operating member so that printing, cutting or perforating is performed on a web of material as it passes between the operating and cooperating members and the operating member is rotated. The method as it applies to an offset press comprises the steps of setting the frame supports to a predetermined temperature above the ambient, situating the bearers so that there is a selected space between them, packing the blanket cylinder "lightly" such that the radius of the blanket cylinder is slightly greater than the radius of the bearers, monitoring the space between the bearers during operation of the press, and adjusting the temperature of the frame supports to keep the distance between the bearers adequate to assure satisfactory print quality.

Heating the frame supports to an initial temperature above ambient temperature and positioning the bearers such that there is a predetermined distance between them and permits the distance between the bearers to be adjusted during operation of the press by varying the temperature of the frame supports. Because the bearings are attached to the frame supports, increasing the temperature of the frame supports increases the frame supports effective length thus increasing the distance between bearers. Thermally adjusting the distance between the bearers via increasing the length of the frame supports offsets any increase in the radius of the bearers due to centrifugal force caused by operating the press at high speeds. Alternatively, the distance between the bearers may be decreased by decreasing the temperature of the frame supports when off-bearer operation is not desired. The temperature control is coordinated or synchronized with the speed of rotation of the machine by controlling the temperature in proportion to that speed of rotation.

By running the press "off-bearer", friction created by the contact between bearers is removed. This elimination of friction reduces heat buildup on the edges of the blanket and plate cylinders, thus the cylinders remain straight resulting in a more even dot structure across the web. Also, by running "off bearer" the energy required to operate the press is reduced as less energy is need to overcome the frictional forces operating on the bearers. The elimination of frictional forces acting on the bearers reduces downtime or lost production cost due to bearer and bearing failure. Furthermore, the elimination of heat caused by friction greatly reduces blanket and plate cylinder maintenance. Additionally, maintaining bearer gaps keeps the cylinder ends cooler, which reduces scumming or drying of the dampening solution at web edges thus maintaining print quality.

Brief Description Of Drawings

The invention of the present application will be better understood from a review of the detailed description with reference to the drawings in which FIG. 1 is a schematic diagram showing paper flow through a printing press.

FIG. 2 is a partially sectioned view of the printing press of FIG. 1 taken along the line 2-2 in FIG. 1 showing a printing press running without the present invention and is representative of the prior art.

FIG. 3. is a partially sectioned view of the printing press of FIG. 1 taken along the line 2-2 in FIG. 1 showing a printing press running with the present invention.

FIG. 4a-d are schematic diagrams showing the gap between bearers during operation of a press utilizing the present invention.

FIG. 5 is a side view of a non-bearered or Flexo press.

Detailed Description

FIG. 1. shows schematically an offset printing operation wherein a web of paper 100 is passed through an offset printing press 102 which is shown as a single printing stage or station, however typically would comprise several printing stages. The paper web 100 is passed from the printing press 102 through a variety of post printing equipment such as a dryer and/or chill rolls indicated generally at 104. The web 100 is next fed through a rotary cutter 106 where the web 100 is intermittently severed to form sheets or pages 108, which pages may comprise one or more sheets of printed material. The rotary cutter 106 may, for example, be a part of a sheeter 110 such as that illustrated in U.S. Patent No. 3,994,221.

In the offset printing process, the equipment for each printing stage or station includes a pair of inked plate cylinders 112, each carrying ink images of matter to be printed on the two sides of the paper web 100 and two offset or blanket cylinders 114 for transferring the ink images from the plate cylinders 112 to the paper in the desired registry. The transfer surfaces on the blanket cylinders 114 are provided by sheets or blankets wrapped around the cylinders and secured thereto by suitable clamping means (not shown) disposed in transverse slots or gaps 114A extending throughout the length of the cylinders. During the actual printing

operation, the two blanket cylinders 114 also serve as backing or impression cylinders each for the other, the moving web 100 engaging both in a common transverse contact zone so that both sides of the web are printed at the same time. The two blanket cylinders 114 are phased so that the blanket joints or gaps 114A of both revolve through the common contact zone and in register with the spacing or transverse border area between successive printings or signatures.

Sheets or plates containing the impression to be printed onto the paper web 100 are similarly wrapped around the plate cylinders 112 and secured thereto by suitable clamping means (not shown) disposed in transverse slots or gaps 112A which similarly extend throughout the lengths of the plate cylinders 112. The blanket and plate cylinders 112, 114 are phased so that the blanket joints or gaps 114A and the plate joints or gaps 112A of the blanket and plate cylinders similarly revolve through a common contact zone and in registry with the spacing or transverse border area between successive printings or signatures.

The impression pressure between the blanket cylinders 114 can be set in a variety of ways well known in the art, such as by adjustment screws and apparatus 116. Similarly, the impression pressure between the blanket cylinders 114 and the plate cylinders 112 can be set in a variety of ways well known in the art, such as by adjustment screws and brackets 118. In existing printing presses, the impression pressure between the blanket cylinders and between the blanket cylinders and plate cylinders is set while the printing press is at rest.

Referring to Fig. 2, which is included as representative of the prior art, some of the major shortcomings of a conventional offset press running without using the present invention are shown. Because heat is generated by the bearers 112b and 114b engaging each other plate cylinder 112 bows causing bearer 112b to lift off on the inside (shown at B) and journal 115 to pull away from bearer 112b (shown at C).

Uneven dot structure is insured due to plate cylinder 112 bowing as shown at D. These problems associated with running an offset press without the present invention are easily overcome utilizing the present invention.

FIG. 3 shows a partially sectioned view through the blanket and plate cylinders and the supporting sidewalls of the printing press 102 taken along line 2-2 shown in FIG. 1.

The blanket cylinders 114 includes bearers 114b and the plate cylinders 112 includes bearers 112b. Bearers 112b and 114b are illustrated here to show fully the method of the present invention and it should be appreciated that the exact size or shape of any of the bearers is a design consideration and does not form part of the present invention. The blanket cylinders 114 are shown having a smaller radius than bearer elements 114b. However, to achieve off-bearer printing, the blanket cylinders 114 must first be packed when the machine is at rest such that the packing extends the effective radius of each blanket cylinder 114 beyond the radial length of the bearers 114b. By packing the blankets in this manner, pressure will be applied between the blanket cylinders 114 before bearers 114b come into contact. This initiates the "impression" of the press.

Initially the frame supports are heated to a predetermined temperature above the ambient temperature, thus growing the effective lengths of the frame supports and consequently increasing the distance between the bearers. By heating the frame supports 202, 204 to an initial temperature above the ambient temperature, the distance between bearers 114b is increased. Bearers 114b are then mechanically positioned with a predetermined space or distance between them prior to operation of the press. The space A eliminates friction caused by the bearers 114b engaging one another. The space A between the bearers 114b is set by adjusting the bearings on frame supports 202, 204 in a position such that the bearers 114b which are attached to the bearings are not in contact. Thus, the bearers 114b are positioned for off bearer operation while the press is at rest. In an alternative embodiment, the press may be operated by mechanically positioning the bearers before the frame supports have been heated.

After frame supports 202, 204 have been heated to grow their effective length and the bearers 114b and 112b have been positioned for off bearer operation, the blanket and plate cylinders are packed to achieve the desired impression pressure on the web of paper 100. The blanket cylinders 114 and plate cylinders 112 are packed such that the radius of the cylinders is slightly greater than the radius of the connected bearers. This procedure assures a constant pressure between blanket cylinders and between plate and blanket cylinders and printing is effected on the web of paper passing between blanket cylinders 114.

As the blanket 114 and plate cylinders 112 rotate one against the other the cylinders 112,114 as well as the bearers 112b, 114b, tend to grow along their radial dimension. The positions of the bearings 200 in the side frames 202 and 204 of the press are maintained constant. In order to maintain the preset off bearer frictionless operation and to avoid problems caused by the engagement or contact of the bearers 114b, the press is precisely adjusted during operation by controlling the temperature of the section of the frames 202 and 204

located between the bearings 200 supporting the plate and blanket cylinders. In the preferred embodiment, these frame sections are constructed from a material having a positive co-efficient of thermal expansion since heating elements are used for the thermal control. By controlling the temperature of the frame portions separating these bearers, the frame dimensions can be increased or decreased by thermal expansion or contraction of those portions of the frame by an amount approximately equal to the growth of the bearers due to centrifugal force, bearer wipes and heating and other well known factors.

Precisely adjusting the distance between bearers 114b during high speed operation of the press is accomplished by correspondingly raising or lowering the temperature of the frame supports. Raising and lowering the temperature of the frame supports 202, 204 maintain an appropriate distance between bearers 114b, preferably the preset distance between bearers 114b simultaneously maintains the initial positioning of the blanket 114 and plate cylinders 112.

By way of example, the portions of the framework separating the bearers which support the cylinders are controlled by thermal heating elements shown in FIG. 3 as either strip heaters 300 positioned on either side of the frame or circular heating elements 302 which are inserted into small holes drilled either partially or totally through the supporting framework. The strip heaters 300 are held in place by flanges 304 or by other appropriate supports. Press frames are generally constructed of steel and are of substantial rigidity and strength so that holes drilled to receive heating elements 302 should not effect the strength of the support members.

The positioning of the heating elements is best seen in FIG. 3 as being oriented along a line generally normal to the line interconnecting the centers of the associated cylinders which are effected by the heating elements. As shown in FIG. 3, two cylindrical heating elements 302 are positioned between the two blanket cylinders. Strip heaters 300 are positioned between the blanket to plate cylinders. It is not necessary to maintain the entire frame support at the temperatures required to "grow" the frame. The temperature of the portions of the frame centered between any two cylinders can be adequately controlled to produce the dimensional changes required to compensate for the centrifugal and heat growth produced by high speed operation of the printing press. It should be understood that the gap between any two cylinders or bearers can be monitored and adjusted separately or all gaps may be monitored simultaneously. The manner in which the growth of the frame is adjusted relative to the speed of rotation is fully described in U.S. Patent No. 4,426,897. Although strip heaters and cylindrical heaters have been disclosed, other types of heating apparatus or temperature control apparatus can be used in accordance with the present invention.

The effect of employing the present method on a conventional offset press is best shown in Fig. 4. Fig. 4a shows a gap 501 between plate cylinder bearer 112b and packing cylinder bearer 114b when the bearers are initially positioned prior to operation. By increasing the temperature of frame supports 202 and 204 above the ambient and growing frame supports 202 and 204 a larger gap 502 is created between plate cylinder bearer 112b and blanket cylinder bearer as shown in Fig. 4b. The gap 502 is adjusted to a predetermined distance by varying the temperature or making standard mechanical adjustments.

As the cylinders and bearers begin to rotate, centrifugal force and heating grow the effective radii of plate cylinder bearer 112b and blanket cylinder bearer 114b closing the gap between plate cylinder bearer 112b and blanket cylinder bearer 114b as shown in Fig. 4c to a gap 503. Fig. 4d shows plate cylinder bearer 112b and blanket cylinder bearer 114b again with gap 501 between them due to an increase in the heat supplied to frame supports 202 and 204 to compensate for the centrifugal force acting on the cylinders and bearers, thus maintaining a desired gap between bearers for optimal printing efficiency.

Fig. 4a-4d are exaggerated to show the effect the present invention has on a conventional offset press. It should be understood that in operation the speed of rotation is constantly monitored or the gap is visually or through other means constantly monitored and the heat supplied to grow frame supports 202 and 204 is adjusted correspondingly, thus the gap between the plate cylinder bearer and blanket cylinder bearer, and the gap between the blanket cylinder bearers is maintained at substantially constant.

Alternatively, the method disclosed herein is equally adaptable to Flexo or non-bearered presses. Fig. 5 shows a typical Flexo printing unit. Paper web 400 is fed between impression cylinder 405 and plate cylinder 410. Plate cylinder 410 receives ink when cooperating with the grooved or annolux roll 415. Simultaneously, plate cylinder 410 cooperates with impression cylinder 405 transferring the designated configuration to paper web 400 as it passes between impression cylinder 405 and plate cylinder 410.

Even though bearers are not used in a flexo press, and therefore do not engage each other causing heat and deflection of the cylinders, it is difficult to maintain print quality at high speeds of operation, thus the method of the present invention

can be utilized for increasing print efficiencies.

The method, as applied to this bearerless type printing press would include setting the frame supports to an initial temperature above the ambient, effectively lengthening the frame supports and consequently increasing the distance between impression cylinder 405 and plate cylinder 410, (indicated as 401 in Fig. 5) and plate cylinder 410 and annolux cylinder 415 respectively (indicated as 402 in Fig. 5). The position of the impression cylinder relative to the plate cylinder, and the portion of the plate cylinder relative to the annolux cylinder would then be set prior to operating the press. While the machine is operating the original position of the operating cylinders is maintained in the same manner as the offset bearered press. Thus the initial optimum setting of the operating cylinders is approximately maintained thereby maintaining the print quality during the entire time of operating the machine, and at all speeds of operating the press.

It is therefore evident that this control method is intended to be equally applicable to all types of printing presses. This invention is not limited to the aforementioned embodiments, and various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of the invention.

Claims

1. A method of controlling apparatus to perform an operation on material passing therethrough, the apparatus comprising a frame having first and second support portions, a plurality of bearings mounted on the supports, a plurality of bearers each mounted to a respective one of the bearings for rotation thereabout, an operating member connected to a first pair of bearers, a cooperating member mounted to a second pair of bearers and disposed relative to the operating member so that the desired operation is performed on the material as it passes between the operating and cooperating members, said method comprising:

   heating the first and second support portions of the frame to an initial temperature above the ambient temperature;

   fixing the relative position of the first pair of bearers associated with the operating member and the second pair of bearers associated with the cooperating member to provide a predetermined spacing between the first and second pair of bearers;

   adjusting the temperature of the first and second support portions of the frame during operation to maintain a spacing between the first and second pair of bearers.

2. A method of operating a printing press for printing on a web of paper passing therethrough, the press comprising a frame having first and second support portions, a plurality of operating members connected to the frame, said operating members disposed relative to each other such that printing is performed on the web of paper as it passes between the operating members as the operating members rotate, said method comprising:

   heating the first and second support portions of the frame to an initial temperature above the ambient temperature;

   fixing the position of the operating members to provide a predetermined spacing between operating members;

   packing the operating members to achieve the desired impression on the web of paper as it passes therebetween; and

   adjusting the temperature of the first and second support portions of the frame during operation to maintain the selected spacing between operating members.

3. A method of controlling a printing press to print on a web of paper passing therethrough, the press comprising a frame having first and second support portions, a plurality of bearings mounted on the supports, a plurality of bearers each mounted to a respective one of the bearings for rotation thereabout, an operating member connected to a first pair of the bearers, a cooperating member mounted to a second pair of the bearers and disposed relative to the operating member so that printing is performed on the web of paper as it passes between the operating and cooperating members, said method comprising:

   heating the first and second support portions of the frame to an initial temperature above the ambient temperature;

   fixing the relative position of the first pair of bearers associated with the operating member and the second pair of bearers associated with the cooperating member to provide a predetermined spacing between the first and second pair of bearers;

   packing the operating member to achieve a radial length extending slightly beyond the radial length of the associated first pair of bearers;

   adjusting the temperature of the first and second support portions of the frame during operation to maintain a selected spacing between the first and second pair of bearers.

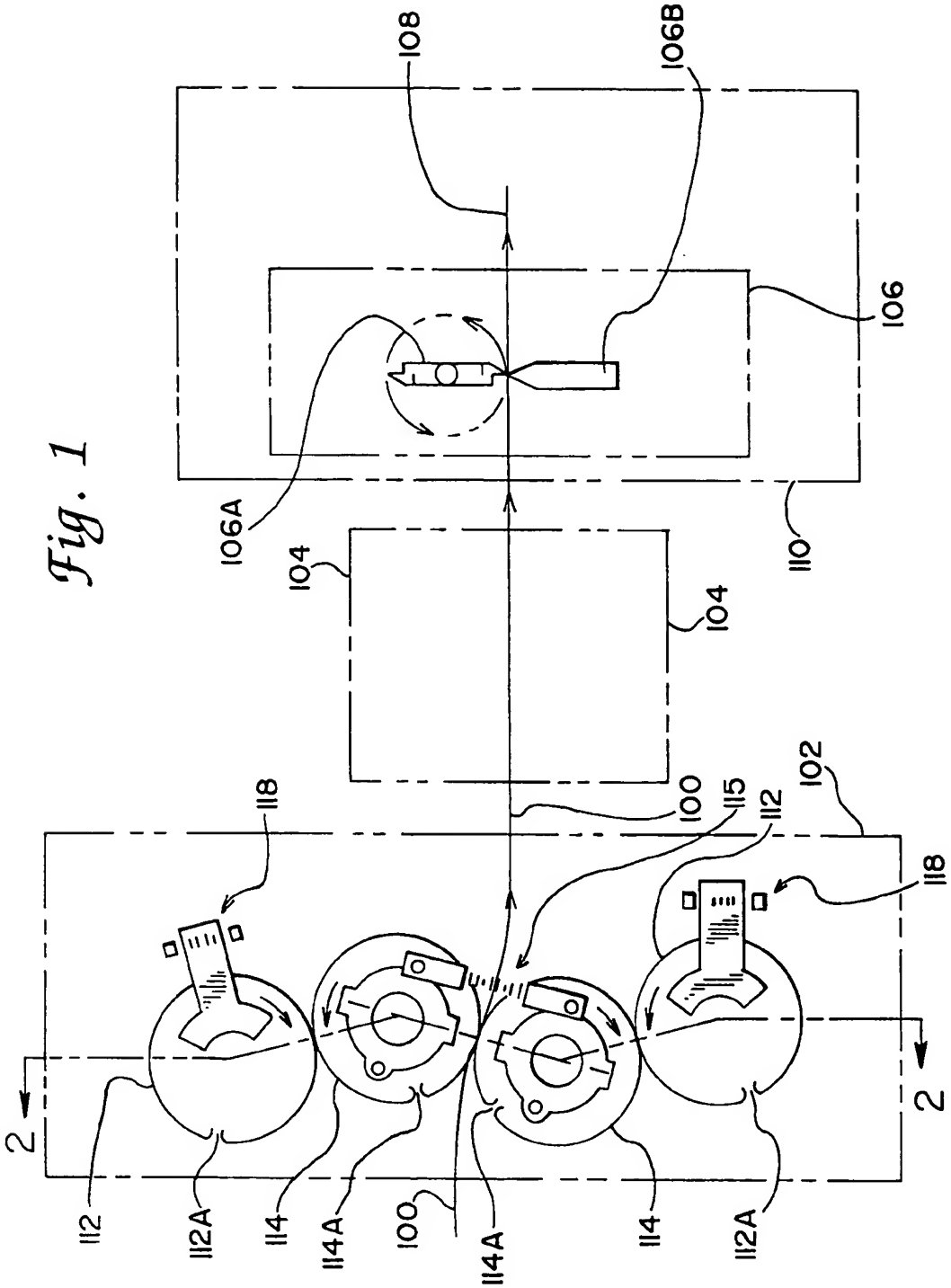
108
106B
106
106A
110
104
104
102
118
100
115
112
118
2
2
112
112A
114
114A
100
114A
114
112A

Fig. 1

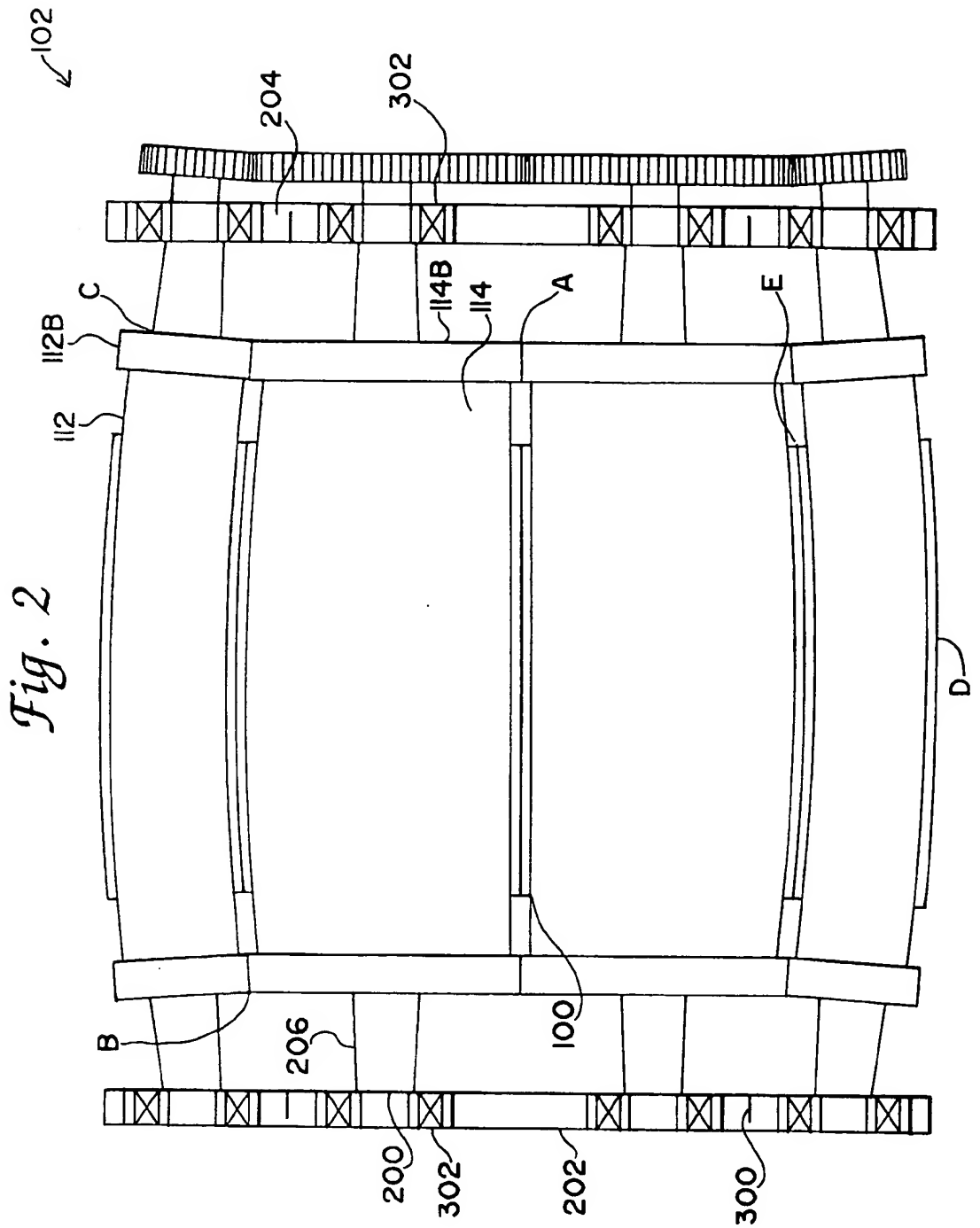

Fig. 2

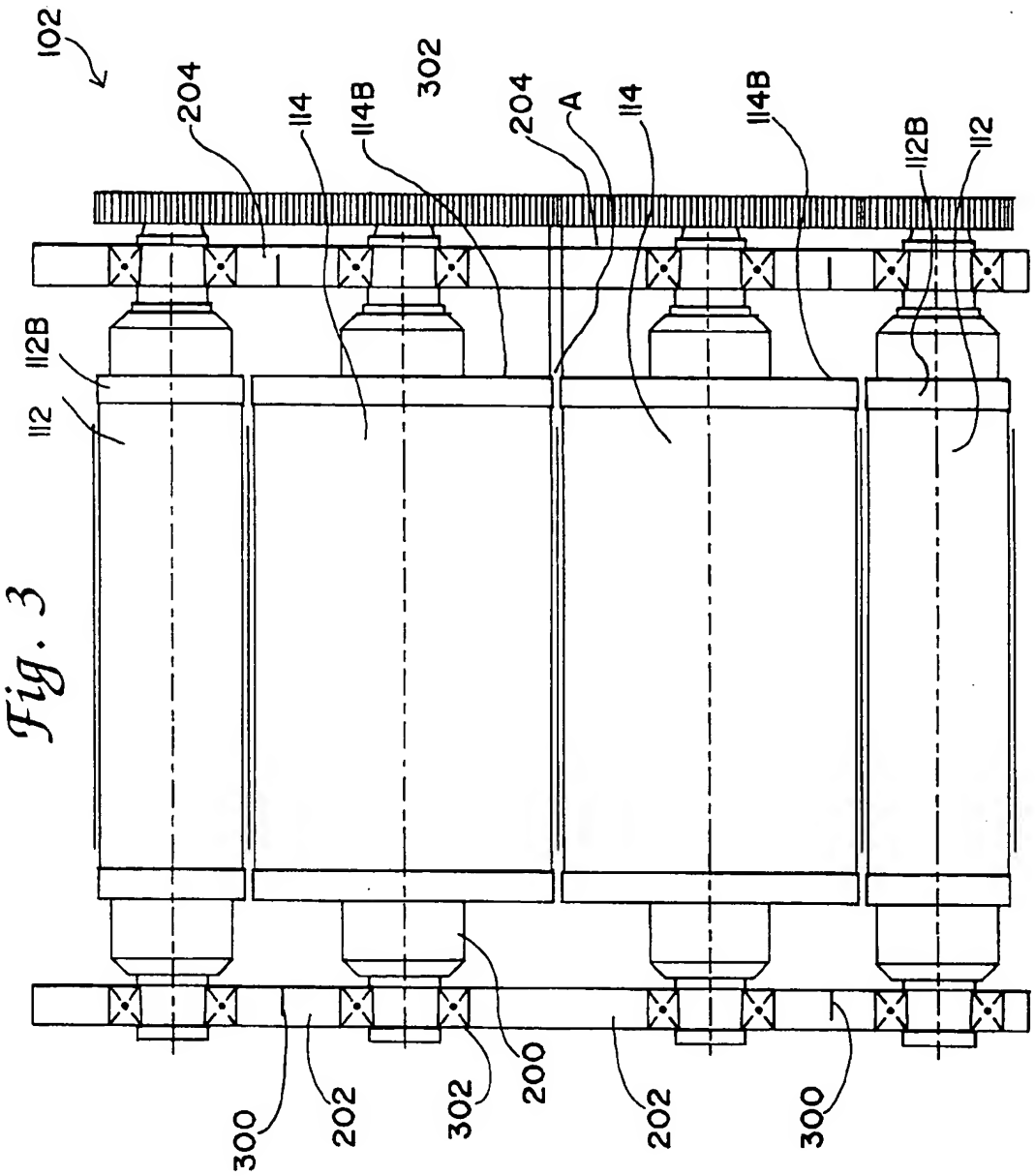
102
204
114
114B
302
204
A
114
114B
112B
112
112B
112
300
202
302
200
202
300

Fig. 3

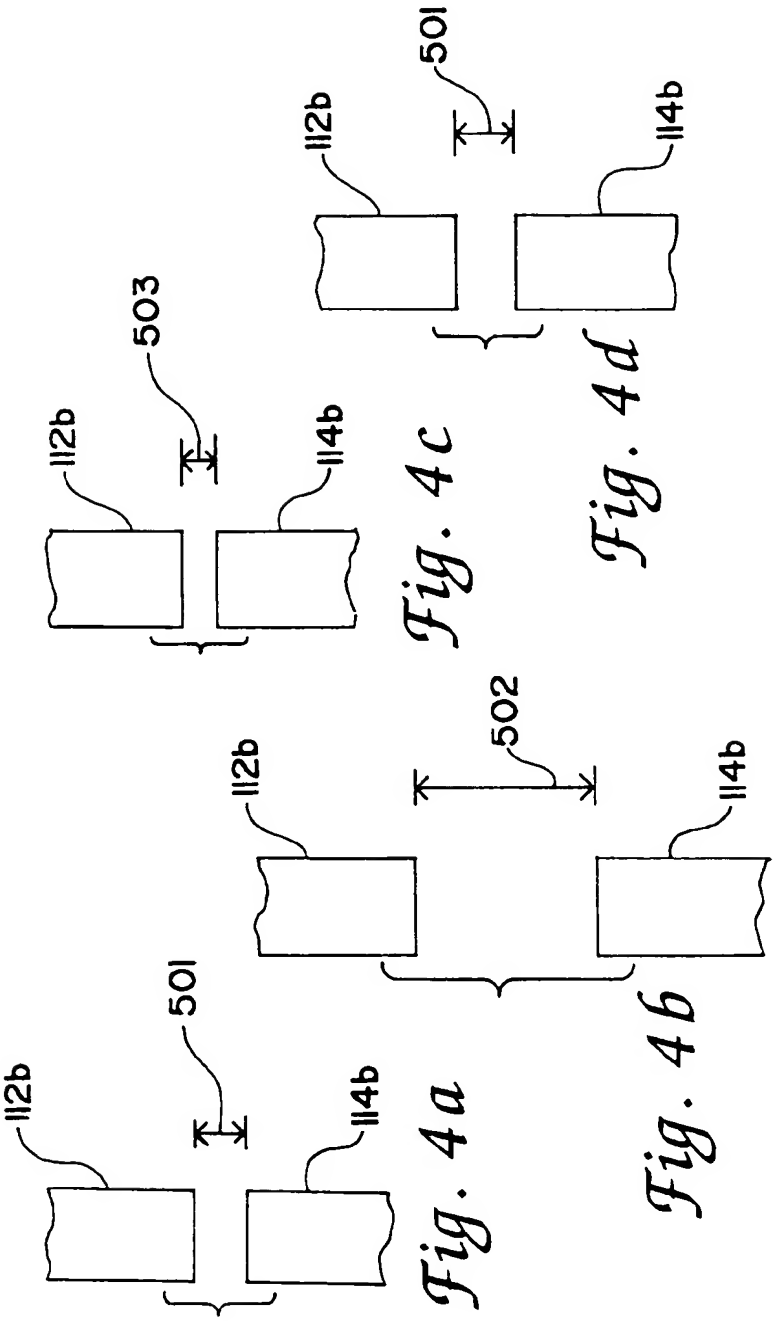

Fig. 4a

Fig. 4b

Fig. 4c

Fig. 4d

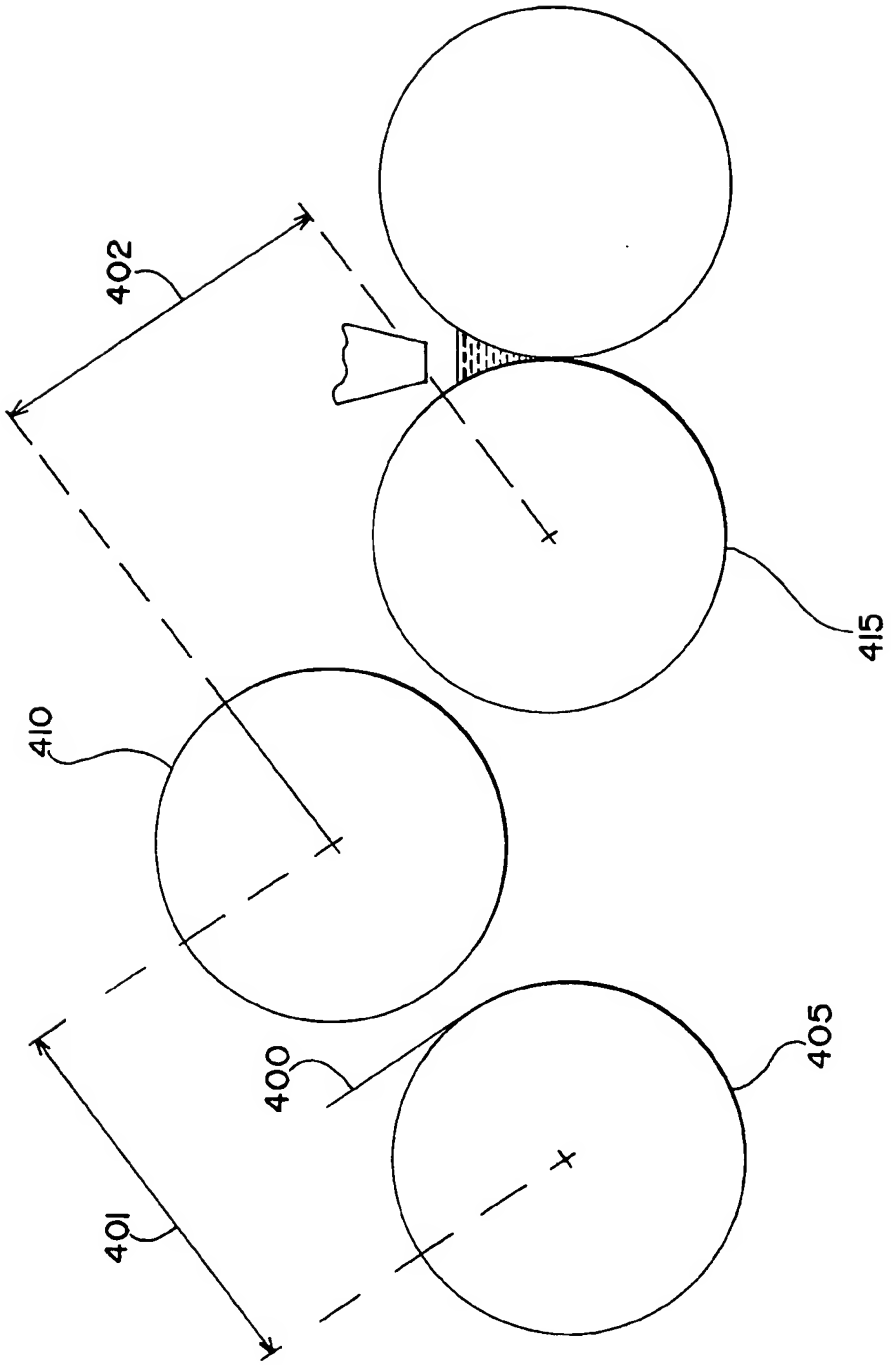

Fig. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 11 4491

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,X	US-A-4 426 897 (LITTLETON F.J.) * column 4, line 3 - line 36 * -----	1-3	B41F13/34
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	09 MARCH 1992	THIBAUT E.E.G.C.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document